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Thus much for the greatest of the Royal Families of Plants. Of the others we may speak hereafter. Their importance is not less than we have ascribed to these, and in some respects they far outvie the great division before us. From the study of their extended ranks we can but gain instruction; from their wonderful involutions there will still shine out a new light on the workings of that Spirit at whose bidding "the earth brought forth grass, the herb yielding seed, and the tree yielding fruit after its kind."

THE MOSS-ANIMALS, OR FRESH WATER POLYZOA.

PLATE 4.

BY ALPHEUS HYATT.

(Continued from p. 63.)

THE blood of the Phylactolæmata is colorless, resembling in this respect that of most of the lower animals. It is composed of the liquid products of digestion, which exude through the membranes of the stomach, diluted with water drawn in through innumerable pores perforating the wall of the tube. The water is the medium of conveyance for the gelatinous, nutritious liquid, probably facilitating its carriage to remote parts.

There is no organ resembling a heart to keep the blood moving, and there are no closed channels, such as arteries and veins, to conduct it among the tissues of the body. The absence of the first is supplied by cilia, which cover the interior of the tubes and cells with a dense, velvety nap, and by their unceasing vibrations sustain a healthy circulation. The course of this may be traced by the numerous floating parasites, beings of the simplest organization, consisting either of a single cell, or of larger cells containing many others, the cycle of whose lives is passed within the polyzoön, feeding upon its juices. These indicate the passage of a common stream up the branches, and a return current along the free side, which flows into each tube.

Our Polyzoön, also, has no breathing organs, neither lungs or gills to bring the blood in contact with the air, of which element there is always more or less in water, serving there as upon land, for the respiration of animals. The tentacles are supposed to be more especially devoted to this purpose, and the water admitted to the interior must necessarily purify the blood by the air it brings in, but nothing more definite is now known with regard to this function.

The Moss-animals have two modes of reproduction, one by buds, the other by eggs. The former occurs in two ways, by free buds or statoblasts, and by sprouting buds, which develop only in summer.

The statoblasts are destined to carry their burdens of vitality safely through the hardships of winter, and to perpetuate the race by founding new colonies in the spring. They appear at first in the shape of bead-like swellings from the centre of an organic cord, which connects the stomach with the cell (plate 3, fig. 4, and plate 4, fig. 1), passing between the bases of the muscles, which retract the tube. They begin as single cells, but these soon separate into two, then into four, and so on, indefinitely. The accumulated mass then presses to the outer surface of the cord, and becoming invested with a thick, horny, brown envelope (plate 4, figs. 2 & 3, w′), falls off at last into the cavity of the body. This horny sheath in some genera also acquires a solid ring, or annulus (plate 4, figs. 2 & 4, w''), and in others, for example in Pectinatella (plate 4), may have the edge of the ring ornamented with delicate spines furnished with hooks.

Late in autumn the Polyzoön dies, and the statoblasts are set free to float during the long winter, the sensitive germ within being protected from the frost only by their tough coatings. They retain their vitality, however, until the warmth of returning spring awakens their suspended powers of growth. The young Polyzoön then increases in bulk, until it splits the sheath apart, and protrudes beyond the edges. The organs are well advanced when this takes place, and the tube has already acquired its adult habit of retracting the plumes upon the slightest provocation. Its youth is a sunny holiday passed in the open water, where it swims freely by the aid of cilia, which clothe the outer surface, but the sides of the statoblast are finally separated so widely, that they drop off, and the wanderer seeks a resting-place under some old log or stone. Here a little gelatine, which subsequently becomes the tough, brown envelope (plate 3, D), fastens it to the surface, and henceforth its fate is inseparably linked to that of an inanimate mass. When securely anchored, and in some cases while still free, a little bulb appears externally on one side, and, growing larger, stretches into a minute cell, within which a young polyzoön is discernable. This was primarily a tiny, saclike bud, formed by the bending inwards of the wall in the parent cell, close to the bases of the muscles of the fold (plate 1, fig. 5, Y). The throat and stomach are derived from the transverse division of the minute sac into two portions, but it remains to be ascertained whether the intestine is made by an after-growth from the stomach, or by the division lengthwise of the throat. The tentacles arise from the thickened rim, and draw out between them a web, which afterwards receding externally, becomes the veil, and the wall of the tube is merely an elongation of the membrane connecting the rim of the sac with the parent.

The cell-bulb does not protrude externally until these organs are mapped out. The young one, though still very imperfect, begins to stretch forth its arms as soon as the cell, or cœnœcium, as it is more appropriately called, is well extended, and long before the characteristics reach perfection, gives other evidences of its natural precociousness in the statoblasts and regular buds, which spring up in their respective places within the cœnœcium. At intervals two buds will sprout in different directions, originating new branches, and thus a dendritic colony is gradually built up, which owes its origin entirely to one animal. Consequently the outer branches are the youngest, and often, as in plants, these are vigorous and quick with life, while the parent trunk is but an empty case, frequently with nothing left to indicate its position but the decaying cœnœcia, or their faint tracery in the slime.

The second mode of reproduction, by eggs, takes place only in the newly established colonies during the earlier summer months. These eggs are little colorless vesicles, developed internally from a bead-like swelling on the free side of the wall, near the orifice. When ripe they are dropped into the cavity of the cœnœcium, and there meet with the fertilizing filaments which have been developed from a similar bud upon the organic cord. We perceive from this that our polyzoön is, physiologically speaking, neither male or female, but of the collective gender, an hermaphrodite, combining the reproductive powers of both sexes.

The eggs eventually attain the size of a statoblast (about one-thirtieth of an inch long), and have an oval outline. When full grown, their exterior is also clothed with cilia, which render them capable of rapid motion, and at this period they may be sometimes seen squirming in the tube, and tossing the stomach about with great violence. No orifice for their emission from the body has been discovered, and we have every reason to believe there is none, and that they force their way into the world directly through the walls of the body. In fact, Mr. Albany Hancock, an English naturalist, has observed a full-grown egg, which obtained its liberty by pressing through the closed orifice of the cell, rending and destroying the parent in its course.

The cœnœcia, composing the trunks of the older colonies, are always empty, as previously stated, in the autumn, and it is not improbable that they are the remains of the unfortunate parents whose death was caused earlier in the season by their restless offspring, since all, even the younger autumnal polyzoa are incapable of bringing forth eggs, and produce only statoblasts and regular buds.

The polyzoön is developed from an internal bud at one end of the egg, and when sufficiently large bursts the outer envelope, coming forth like the polyzoön of the statoblast, armed with abundant cilia, by whose aid it swims. Like this, also, after a time its wandering ceases; it seeks some dismal retreat, glues itself to the surface, and becomes the progenitor of a new colony.

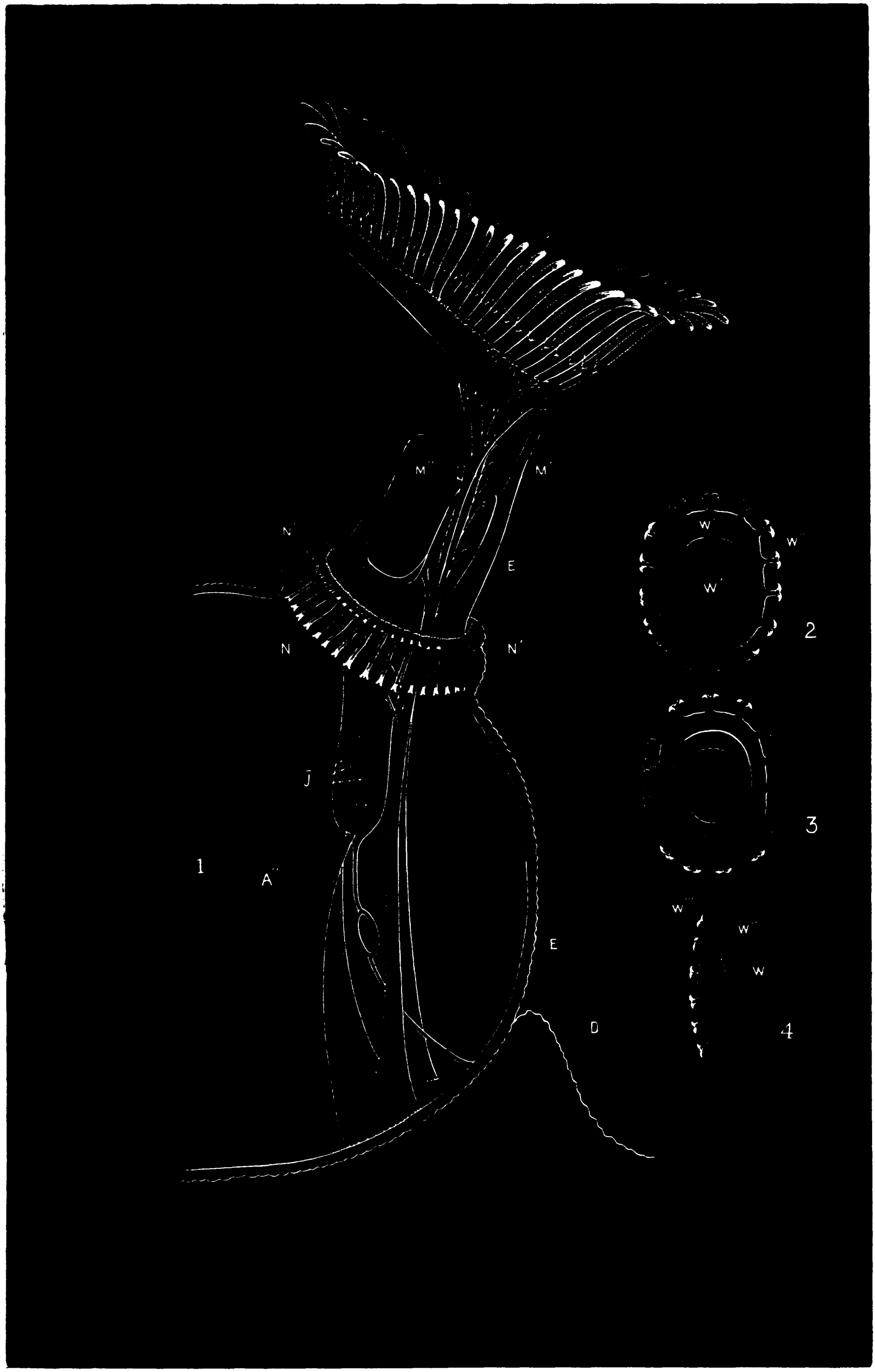
All Polyzoa, both marine and fresh water, in common with other attached and branching forms, such as the corals among the Radiata, have been called Phytozoa, or plant-animals, but, like all others of this kind, their young, born from the egg, are free.

Although thus resembling corals, they are widely separated from them by their structure. Each little animal, when reduced to its typical form, is a simple sac containing the stomach, and is allied to the clam, the oyster, and the snail, all of which have the same plan of structure. The coral, as may be seen by looking closely into any one cell, has a number of thin plates all pointing from the rim toward the vacant centre, like the spokes of a hubless wheel, and is, therefore, related to the star-fish, jelly-fish, and others, which have the parts arranged in a star-like or radiatimg manner. Thus, while by a process of budding, animals may be grouped into shrub-like colonies, with an external resemblance to each other and to the plants, with which the older naturalists classed them, their internal structure may show that they belong not only to animals, but to very distinct branches of the animal kingdom.—*Concluded in next number.*

EXPLANATION OF PLATE 4. *Pectinatella magnifica* Leidy.

Fig. 1. Enlarged view of one polyzoön, situated on the end of a branch, which in Pectinatella (see No. 2 of this Magazine) is only a hollow lobe. A″, cavity of this lobe; D, mass of gelatine below; E, wall of this lobe and tube; J, brown stripes in the stomach, the hepatic folds; M′, M″, muscles for withdrawing the tube, retractors; N, N′, muscles of the fold, which in this species is very narrow.

Figs. 2, 3, 4, the upper and lower side, and profile view of the statoblast; W′, horny sheath; W″, annulus; W‴, spines with hooks.



HYATT ON THE MOSS ANIMALS.